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STAFF REPORT AND RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-102-99**
Staff:	JRR-SF
File Date:	10/6/99
45th Day:	11/20/99
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Commission Meeting:	11/2/99

FEDERAL AGENCY: **NATIONAL MARINE FISHERIES SERVICE**

DEVELOPMENT LOCATION: Offshore of the Cities of San Diego and Imperial Beach (Exhibit 1)

DEVELOPMENT DESCRIPTION: Small-scale test of a pulse-power device used to deter sea lions' depredation on fish caught on sport fishing vessels

EXECUTIVE SUMMARY

The National Marine Fisheries Service (NMFS) has submitted a consistency determination for a small-scale test of a pulse power device used to deter sea lions depredation on charter fishing vessels. The tests would be conducted offshore of the cities of San Diego and Imperial Beach, in southern California. The test would take place over a series of approximately 327 vessel cruises over a period not to exceed five months. The test is designed to investigate the effectiveness of the pulse power device to deter sea lions from approaching the chartered fishing vessel. The pulsed power device produces a discharge that includes a compressed wave (shock wave) and an acoustic wave. NMFS believes that the combination of acoustic and compressed waves may be more effective at deterring sea lion depredation.

The proposed test has the potential to adversely affect marine mammals, sea turtles, and other marine species. The device would emit a sound and shock wave that may deter sea lions from coming too close to the vessel. NMFS proposes to monitor for non-target marine mammals and other species to prevent exposing any non-target organism to sound levels greater then 180 dB re 1µPa. In addition, NMFS proposes

to turn off the device if a sea lion approaches close enough to be exposed to sound levels greater than 205 dB re 1µPa. The sound level that the sea lions would be exposed to is significantly higher than the 180 dB re 1µPa, which NMFS believes to be the threshold for temporary damage to marine mammal hearing. Therefore, the proposed project may adversely affect the sea lions.

In addition, the proposed project may not provide enough protection to non-target animals. In its environmental assessment, NMFS proposes to monitor for non-target species. However, the Commission is concerned that the monitoring would not be adequate to prevent harmful exposure to both target and non-target species. Therefore, the proposed project does not protect biologically significant or environmentally sensitive species and it is inconsistent with Sections 30230 and 30240 of the California Coastal Act.

The purpose of the device is to protect recreational fishing on chartered vessels. According to the NMFS, sea lion depredation is having both an economic and social economic effect on this fishing resource. However, NMFS did not provide adequate evidence to demonstrate that there is an economic effect on the recreational fishing industry (protected under Sections 30234 and 30234.5 of the Coastal Act). There is enough information to conclude that sea lions are affecting the recreational value of the fishing (protected under Sections 30220 and 30234.5 of the Coastal Act) and that the device could improve this recreational resource.

The proposed project, however, has the potential to affect recreational diving (Section 30220 of the Coastal Act). Although NMFS proposes mitigation for this potential impact, the mitigation is not adequate to ensure protection of this resource. Therefore, the project is not consistent with the recreational resource policy of the California Coastal Management Program (CCMP).

SUBSTANTIVE FILE DOCUMENTS:

1. Environmental Assessment for testing a pulse power generator to reduce California sea lion depredation of gear and catch aboard an actively fishing charter boat off southern California, October 5, 1999.

2. Letter Dated June 11, 1999, from Joel R. Reynolds, Natural Resources Defense Council to Sara Wan, Chair, California Coastal Commission (Exhibit 2).

3. *Marine Mammals and Noise*, W. John Richardson, Charles R. Greene, Jr., Charles I. Malme, Denis H. Thomson, 1995.

4. *Behavioral Responses and Temporary Shift in masked Hearing Threshold of Bottlenose Dolphins,* Tursiops truncatus, to 1-second Tones of 141 to 201dB re 1µPa, Sam H Ridgeway, et al., July 1997.

5. Consistency Determinations: CD-110-94, CD-95-97, CD153-97, CD-109-98, and CD-32-99.

6. High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California, the High Energy Seismic Survey Team, for the California State Lands Commission and the U.S. Minerals Management Service Pacific OCS Region, September 1996 – February 1999 (Exhibit 3)

STAFF SUMMARY AND RECOMMENDATION:

I. PROJECT DESCRIPTION

The NMFS proposes a small-scale test of a pulse power device intended to deter sea lion depredation on sport fishing charter boats. The test would occur offshore of the cities of San Diego and Imperial Beach and last for a period not to exceed five months. NMFS describes the proposed project as follows:

> *Under this alternative, a limited experimental test of the PPD* [Pulse Power Device] *would be conducted aboard an actively fishing CPFV* [commercial passenger fishing vessel] *off southern California. The test would take place over a series of approximately 327 vessel cruises: one-third of the cruises would involve a vessel with the PPD installed (~109 trips) and the other two-thirds would be aboard control vessels (~218 trips), operating in the same area but without the PPD. Trained field technicians on the test vessel would operate the PPD and serve as on-board observers to collect data on shipboard fishing activities and effectiveness of the device. The duration of the test period would be limited to several months (not more than 5 months) with primary focus on peak sea lion interaction periods (March-May and/or July-September).*
>
> *Experimental protocols will test and evaluate the effectiveness of the PPD at deterring California sea lions from CPFVs and the device's effect on angler catch rate. Specifically, the study is designed to investigate the PPD's effectiveness at driving sea lions away from CPFV operations and preventing their return, evaluate whether the sea lions habituate or avoid the pulsed power transmissions over time (if funds and time permit), and determine if there is a fish catch rate difference between the experimental and the control trials. In addition, mitigation measures provided in the protocols are designed to ensure that during the experiments, no marine mammals (or sea turtles) will be injured. These tests will allow the contractor to collect data to compare measurable rates of angler catch (number of fish caught) and rate of interaction (number of times a sea lion comes within 100m of the boat), from experimental trials (with the PPD "on") and control trials (without the device, or in the "off" position).*

The pulse power device consists of a deck transmitter unit and an underwater unit. The deck unit is a rectangular box with a cable storage reel and is 28 inches high, 24

inches long, and 18 inches deep. It weighs 60 pounds (lbs), without cables. The underwater unit is 8 inches in diameter, and 88 inches long, with a lifting eye hook. With the current stainless steel housing, the underwater unit weighs 215 lbs. The device operator can adjust the pulse rate and output energy level.

The pulse power device can either be manually pulsed or cycled automatically. When manually pulsed, a single pulse can be produced at a rate of no more than that set by the operator. For example, in the single-shot mode, if the timer is set for 10 seconds (6 pulses per minute (ppm)), the start cycle pushbutton, when depressed, would produce one energy discharge, but activating the pushbutton again before the 10 second interval has timed out would not produce another discharge. In the automatic mode, the device would fire a single output wave every 10 seconds (if this interval is selected) and would stop when the cycle knob is turned off.

The device discharges an electric arc between two electrodes immersed in the water column to generate the pulse signal and is capable of a minimum energy output of approximately 1 kilojoules (kJ) and a maximum output of 3 kJ. Although this pulse power device is capable of outputting 3 kJ of energy, NMFS would not test the device at this energy level, because a very large safety zone would need to be monitored for marine species (~450m). In addition, should this prototype become available to fishermen, after the proposed feasibility and further analysis in a laboratory setting have been completed, NMFS would ensure that the device could not be operated at the 3 kJ power setting. The pulse rate of the device is 12 ppm at 1 kJ, and 3 ppm at 3 kJ. The arc creates an omni-directional pulse wave. The pulse frequency ranges from 2.43 kHz to 98 kHz, with a median value of 11.2 kHz. (At these levels, the sound is considered to be high frequency.)

In developing its alternatives, NMFS estimated exposure levels at various distances from the source in order to determine the distance from the source where received levels would reach 180 dB_{RMS} re 1µPa (the “safety zone”). The 180 dB level was recommended by acoustic experts as the maximum level of exposure for marine mammals exposed to high energy impulsive sound sources (airguns) during seismic exploration surveys. The volume of the pulse would be at the 180 dB re1µPa level at 200 meters (656.2 Feet) using the 1.34 kJ power setting on the device. At the 1.8 kJ power setting, the safety zone of 180 dB re 1µPa would be reached at 262 meters (859.6 feet) from the source. The NMFS provides the following table to illustrate the sound pressure levels and energy flux density of the pulse at various distances:

Table 1. Sound pressure levels (dB_{RMS} re 1µPa) and energy flux density (dB re 1µPa ^{2}-sec) calculated for source energy versus distance.

Meters from Source	SPL @1.34 kJ (dB_{RMS} re 1µPa)[1]	SPL @1.8 kJ (dB_{RMS} re 1µPa)[2]	Energy flux density @1.34kJ (dB re 1 Pa^2-sec)[3]	Energy flux density @1.8kJ (dB re 1µPa ^{2}-sec)[4]
1	235	233	199	190
5	218	219	179	176
10	211	213	171	169
15	207	210	166	166
20	204	207	163	163
30	200	204	158	159
50	194	199	152	154
70	191	196	148	151
90	188	193	145	148
100	187	192	143	147

[1]From Equation 8 in Greeneridge (1998a)
[2]From Equation 6 in Greeneridge (1998a)
[3]From Equation 4 in Greeneridge (1998a)
[4]From Equation 2 in Greeneridge (1998a)

The 180 dB re 1µPa protective buffer would be used for all non-target marine mammals and sea turtles. In other words, if any marine mammal, other then sea lions, comes within 200 meters (656.2 feet) at the 1.34 kJ power level or 262 meters (859.6 feet) at the 1.8 kJ power level, NMFS would turn off the device. The sea lions, however, would be exposed to significantly higher volumes. The sea lions would be exposed to a sound pressure level of 205 dB re 1µPa, 18 meters (59.1 feet) from the device at the 1.34 kJ power level and 26 meters (85.3 feet) at 1.8 kJ.

In order to protect marine species, NMFS proposes to hire two technicians to operate the pulse power device and function as marine mammal observers. The observers would also gather data for the experimental trial, including vessel position, time of day, ambient weather conditions, water depth, water temperature, sea state, and other appropriate environmental and physical parameters of the fishing location. In addition, observers would record the number of anglers participating, the time spent fishing at the location, and the number and species of fish caught by anglers. Observers would also record the number and time of sea lions seen farther than 100 meters from the boat and within 100 meters of the boat (defined as an “interaction”). Additionally, the observers would note the number and time of sea lions seen within the protective buffer zone. Observers would record “depredation,” defined as a sea lion removing a fish from a fishing line or a sea lion consuming or destroying a fish at the surface following a suspected depredation event. If possible, the observer would record the number and species of fish lost to sea lions.

In order to mitigate any potential effects, NMFS proposes the following measures:

1. The device will be turned off when sea lions come within the pre-determined protective buffer zone

2. The device will be turned off when any non-target marine mammals or sea turtles are within their pre-determined protective zone

3. The device will not be turned on near marine mammal rookeries or when weather conditions do not permit adequate monitoring of marine mammal protective buffer zones or collection of data (a Beaufort rating of 4 or greater

4. The device will not be turned on if dive flags are in the vicinity

II. STATUS OF LOCAL COASTAL PROGRAM

The standard of review for federal consistency determinations is the policies of Chapter 3 of the Coastal Act, and not the Local Coastal Program (LCP) of the affected area. If the Commission certified the LCP and incorporated it into the CCMP, the LCP can provide guidance in applying Chapter 3 policies in light of local circumstances. If the Commission has not incorporated the LCP into the CCMP, it cannot guide the Commission's decision, but it can provide background information. The Commission has partially incorporated the City of San Diego's LCP and fully incorporated the city of Imperial Beach's LCP into the CCMP.

III. FEDERAL AGENCY'S CONSISTENCY DETERMINATION

The National Marine Fisheries Service has determined the project to be consistent to the maximum extent practicable with the California Coastal Management Program.

IV. STAFF RECOMMENDATION

The staff recommends that the Commission adopt the following motion:

MOTION. I move that the Commission concur with the National Marine Fisheries Service' consistency determination.

The staff recommends a NO vote on this motion. Failure to receive a majority vote in the affirmative will result in adoption of the following resolution:

A. OBJECTION

The Commission hereby **objects** to the consistency determination made by the National Marine Fisheries Service for the proposed project, finding that the project is not consistent to the maximum extent practicable with the California Coastal Management Program.

V. CONSISTENT TO THE MAXIMUM EXTENT PRACTICABLE

Section 930.32 of the federal consistency regulations provide that:

> *The term "consistent to the maximum extent practicable" describes the requirement for Federal activities including development projects directly affecting the coastal zone of States with approved management programs to be fully consistent with such programs unless compliance is prohibited based upon the requirements of existing law applicable to the Federal agency's operations. If a Federal agency asserts that compliance with the management program is prohibited, it must clearly describe to the State agency the statutory provisions, legislative history, or other legal authority which limits the Federal agency's discretion to comply with the provisions of the management program.*

The Commission recognizes that the standard for approval of Federal projects is that the activity must be "consistent to the maximum extent practicable" (Coastal Zone Management Act Section 307(c)(1)). This standard allows a federal activity that is not fully consistent with the CCMP to proceed, if compliance with the CCMP is "*prohibited [by] existing Federal law applicable to the Federal agency's operations*" (15 C.F.R. § 930.32). The NMFS has not demonstrated that this project is consistent to the maximum extent practicable with the CCMP by citing and "statutory provision, legislative history, or other legal authority which limits [their] ... discretion to comply with the provisions of the" CCMP (15 C.F.R. § 930.32(a). Therefore, there is no basis for the Commission to conclude that although the proposed project is inconsistent with the CCMP, it is consistent to maximum extent practicable.

VI. ALTERNATIVES THAT BRING THE PROJECT IN COMPLIANCE WITH THE CCMP

Section 930.42(a) of the federal consistency regulations (15 CFR § 930.42(a)) requires that, if the Commission's objection is based on a finding that the proposed activity is inconsistent with the CCMP, the Commission must identify measures, if they exist, that would bring the project into conformance with the CCMP. That section states that:

> *In the event the State agency disagrees with the Federal agency's consistency determination, the State agency shall accompany its response to the Federal agency with its reasons for the disagreement and supporting information. The State agency response must describe (1) how the proposed activity will be inconsistent with specific elements of the management program, and (2) alternative measures (if they exist) which, if adopted by the Federal agency, would allow the activity to proceed in a manner consistent to the maximum extent practicable with the management program.*

As described in the Habitat and Marine Resources section below, the proposed project is inconsistent with the CCMP. Pursuant to the requirements of Section 930.42 of the federal regulations implementing the CZMA, the Commission is responsible to identify measures, if they exist, that would bring the project into compliance with the CCMP. The Commission believes that it may be possible to

bring this project into compliance with the CCMP if the NMFS implements the following measures:

A. **Buffer Zone.** Increase the buffer zone for the sea lions to prevent that animal from exposure to sound pressure levels greater than 180 dB re 1µPa from the pulse power device.

B. **Monitoring.** Revise the monitoring plan to include.

1. The use of at least two people to monitor for marine animals at any one time, in addition to the person responsible for equipment operation and the person responsible for data collection.

2. The use of equipment, such as passive sonar, underwater cameras, and aerial surveys, to supplement the visual monitoring.

C. **Timing.** The testing of the pulse power device should not occur during nights or in weather conditions where visibility is less than the minimum distance need to view the entire marine mammal buffer zone

D. **Recreational Diving.** Provide maps identifying the location of any regularly used dive area and commit to avoiding testing the pulse power device in the vicinity of those dive areas or at any time when divers maybe present.

VII. FEDERAL AGENCY RESPONSIBILITY

Section C(a)(i) of Chapter 11 of the CCMP requires federal agencies to inform the Commission of their response to a Commission objection. This section provides that:

> *If the Coastal Commission finds that the Federal activity or development project ... is not consistent with the management program, and the federal agency disagrees and decides to go forward with the action, it will be expected to (a) advise the Coastal Commission in writing that the action is consistent, to the maximum extent practicable, with the coastal management program, and (b) set forth in detail the reasons for its decision. In the event the Coastal Commission seriously disagrees with the Federal agency's consistency determination, it may request that the Secretary of Commerce seek to mediate the serious disagreement as provided by Section 307(h) of the CZMA, or it may seek judicial review of the dispute.*

VIII. FINDINGS AND DECLARATIONS

The Commission finds and declares as follows:

A. <u>Marine Resources/Environmentally Sensitive Habitat</u>. Section 30230 of the Coastal Act provides

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30240 provides:

> *(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.*
>
> *(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.*

1. **<u>Marine Mammals</u>**. Marine mammals rely on sound for communication, orientation, and detection of predators and prey. In reviewing the Navy's "LFA" research (Phases I and II, CD-95-97 and CD-153-97 respectively), the Commission noted: (1) the growing evidence that anthropogenic sounds can disturb marine mammals (Richardson et al. 1995); (2) that observed mammal responses to such sounds include silencing, disruption of activity and movement away from the source; and (3) that sound carries so well underwater that animals "have been shown to be affected many tens of kilometers away from a loud acoustic source." The Commission agreed with the Navy in reviewing those research projects that there was a critical need for continuing research to expand the knowledge base concerning human noise impacts on marine mammals.

In its consistency determination the NMFS analyzed potential acoustic effects on a variety of marine mammals and sea turtles in the Southern California Bight. The NMFS describes the types of species that can be found in the area as follows:

> *At least 26 species of odontocetes have been identified from sightings or strandings in southern California (Bonnell and Dailey, 1993). Of this total, eight species can generally be found in moderate or high numbers either year-round or during annual migrations into or through the area. These include the Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Risso's dolphin (*Grampus griseus*), bottlenose dolphin offshore stock (*Tursiops truncatus*), short-beaked and long-beaked common dolphins (*Delphinus delphis *and* D. capensis*), the northern right whale dolphin (*Lissodelphis borealis*), and the Cuvier's beaked whale (*Ziphius cavirostris*).*

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Of the total number of cetaceans that have been identified from strandings and sightings in southern California, there are seven species of mysticetes [Blue whale *(Balaenoptera musculus),* Fin whale (*Balaenoptera physalus*), Gray whale (*Eschrichtius robustus*), Humpback whale *(Megaptera novaeangliae),* Minke whale *(Balaenoptera acutorostrata),* Northern right whale *(Eubalaena glacialis),* and Sei whale (*Balaenoptera borealis). Only one of these species, the gray whale (*Eschrichtius robustus*) has been found in moderate to high numbers and is the only one of the mysticetes that is not listed as a strategic stock under the MMPA.*

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*Four pinniped species are found regularly in southern California, and one additional species, the Guadalupe fur seal (*Arctocephalus townsendi*), is seen occasionally. Of the four regularly-occurring species, only one species, the California sea lion, is common throughout offshore waters throughout the year. Large numbers of northern elephant seals (*Mirounga angustirostris*) pass through offshore waters four times a year as they travel to and from breeding, pupping and molting areas on the Channel Islands. Northern fur seals (*Callorhinus ursinus*) may also be found in offshore waters during the winter and spring when animals from northern populations may feed there. During the rest of the year, moderate numbers of fur seals are found in offshore waters and include only the animals that breed and raise their young on San Miguel Island. Moderate numbers of harbor seals (*Phoca vitulina richardsi*) are found hauled out on land and in coastal waters, but because of their preference for shallow coastal waters, few are found in offshore waters.*

Most of the marine mammals found in these waters are listed as either threatened or endangered under the federal Endangered Species Act. Although not listed as an endangered species, the gray whale migrates through this area. During the early spring, when NMFS proposes to test its pulse power device, gray whales migrate northward with their calves.

1. **California Sea Lion.** The purpose of the pulse power device is to deter sea lion depredation of fish from chartered fishing vessels. As described above, the device would emit both a sound wave and a shock wave, which NMFS believes may be more effect at deterring sea lion depredation and preventing habituation, then other acoustic harassment devices (which only use acoustic energy). NMFS proposes to use a safety buffer around the source so that no sea lion is exposed to sound pressure levels higher then 205 dB re 1µPa. This sound pressure level is higher than is generally considered safe for exposure to marine mammals. Marine mammals rely on sound for communication, orientation, and detection of predators

and prey. In recent years, the Commission's and the public's awareness of the effects of underwater noise, particularly low frequency noise, has increased significantly. In reviewing the Scripps' ATOC[1] and the Navy's LFA[1] research efforts, the Commission noted: (1) the growing evidence that anthropogenic sounds can disturb marine mammals (Richardson et al. 1995); and (2) that observed mammal responses to such sounds include silencing, disruption of activity and movement away from the source

Additionally, the Commission recently objected to a consistency determination by the U.S. Geological Survey (USGS). In objecting to that USGS project, the Commission used the High Energy Seismic Survey (HESS) guidelines for its review of potential impacts to marine mammals (Exhibit 3). In the findings for the USGS project, the Commission stated that:

> *Nevertheless, as noted in the HESS guidelines mentioned above (and attached as Exhibit 3], any received level above 180 dB may raise cause for concern and warrant the need for monitoring and avoidance measures. In addition, the fact that the proposed survey is partly located within the coastal zone, combined with the fact that it triggers the need for National Marine Fisheries Service (NMFS) "take" permit under the Marine Mammal Protection Act (MMPA),[1] mean that the survey would clearly affect the coastal zone and needs to be carefully reviewed by the Commission for marine resource impacts.*

The pulse power device would discharge a brief sound pulse that is in the order 235 dB re 1µPa at its sources. In order to protect the sea lions from temporary or permanent hearing impairment (known as temporary threshold shift or TTS and permanent threshold shift or PTS), NMFS proposes a zone around the sound source that would trigger turning off the device if a sea lion enters it. The zone would protect the sea lions from being exposed to sound pressure levels above 205 dB re 1µPa. This protective sound pressure level is higher than the 180 dB re 1µPa level recommended in the HESS guidelines and that which has been generally accepted by the Commission. In other words, the sea lions may be exposed to sound pressure level that may cause temporary and possibly permanent hearing damage.

In its environmental assessment, NMFS justifies this sound pressure level exposure in this case because it believes that the pulse nature of the sound increases the

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[1] *For purposes of NMFS review under The Marine Mammal Protection Act of 1973 (MMPA) and, for endangered marine mammals, the Endangered Species Act (ESA) of 1973, and their respective amendments, which prohibit taking (including harassment, harm, and mortality), unless under permit or authorization or exempted from the provisions of these Acts.*

pressure level at which temporary or permanent damage is caused. Specifically, in its environmental assessment, NMFS states that:

> *Many studies of the effects of strong airborne noise pulses on human hearing have been done (Kryter, 1985* in *Richardson* et al*., 1995) and most were based on TTS, assuming that noise pulses causing substantial TTS have some risk of causing PTS. From these data, human Damage Risk Criteria (DRC) were developed for airborne impulse noise. The basic criterion specifies the maximum permissible peak pressure during exposure to 100 impulses over an interval of at least 4 minutes on one day. The study found that the DRC diminished by 2 dB re 20µPa for each doubling of pulse duration. In addition, a study by Johnson (1968) investigated the effect of signal duration on detection of tones by a bottlenose dolphin. With shorter pulses, thresholds increased as pulse duration decreased. Thus, very brief pulses, such as those that would be generated by the PPD (<500ìsec), would be significantly less damaging than pulses that were more prolonged, such as those used in the Ridgway* et al. *(1997) study (1 second tone).*
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> *The number of pulses generated per minute, or per day, will also affect the criteria used to assess potential impacts on the hearing of odontocetes by the PPD. At 1 kJ, the PPD emits 12 pulses per minute (ppm); at 3 kJ, it emits 3 ppm (Ayers, R., PPTI, Spring Valley, CA, personal communication, October, 1998). This cycle rate can be controlled by the operator simply by turning the device on and off or by changing the output power level. Airborne studies show that the DRC adjusts upward or downward by 5 dB per 10-fold change in the number of pulses per day and allows levels 5 dB higher if pulses arrive at a grazing rather than a normal angle (*in *Richardson* et al*. (1995)). Thus, for a ten-fold increase in pulses per day, arriving at normal incidence, the DRC would decrease by 5 dB; an animal's hearing is at greater risk when exposed to an increased frequency of pulses.*
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> *Damage risk criteria may also be taken as the number of dB by which the peak pressure must exceed threshold in order to produce some risk of hearing damage (TTS). The human DRCs for airborne impulses are all in dB re 20µPa, and the human auditory threshold in these units is near 0 dB. In the range of best hearing (10 kHz-90 kHz) odontocetes have a thresholds in the range of 40 to 60 dB re 1µPa. Thus, DRCs for these animals might be on the order of 40-60 dB higher than DRCs for humans in air (in dB re 20µPa). If so, the DRC for an odontocete exposed to 100 pulses in one day emitted by the pulsed power generator might be 204-224 dB_{RMS} re 1µPa. (The DRC for humans in air exposed to 100 very brief (25 ìs) pulses in one day is 164 dB re 20µPa; 164 dB+ 40-60 dB re 1µPa (hearing threshold for odontocetes) = 204-224 dB_{RMS} re 1µPa). Richardson* et al*. (1995) emphasized that*

such derived values were speculative, given the unknown relevance of human in-air data to marine mammals underwater, but such studies have been used to analyze impacts of sound on marine mammals, in the absence of data (e.g. Department of the Navy, 1998a).

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For pinnipeds in water, transient events, such as the pulsed sound emitted from the PPD, should be considered to have a significant impact on individual animal(s) if there is potential for TTS. Momentary alert or startle reactions in response to a single transient sound should not be considered significant. TTS thresholds for pinnipeds in water have most recently been reported by Kastak, et al.*, (1999), who exposed one harbor seal, two California sea lions, and one northern elephant seal to pure tone signals (500 ms duration) that lasted a total of 20-22 minutes. Test frequencies ranged from 100 Hz to 2000 Hz and octave-band exposure levels were approximately 60-75 dB sensation level (at center frequency). Following exposure, the harbor seal showed an average threshold shift of 4.8 dB, one sea lion showed an average threshold shift of 4.9 dB, and the elephant seal experienced an average threshold shift of 4.6 dB. Recovery to baseline threshold levels was observed within 24 hours. Because the PPD emits shorter sound signals (<500 ìsec versus 500 msec) with less duration (one pulse every 10 seconds versus many pulses in a 20-22 minute period) and has different sound specifications (higher frequencies, non-pure tone) than those used in the Kastak* et al*. (1999) experiment, it would be difficult to extrapolate the results to the proposed PPD test. The only other information on noise-induced TTS or PTS for pinnipeds is for a harbor seal, who was intermittently exposed to an airborne noise and suffered TTS for one week (Kastak and Schusterman, 1996). Since the PPD will be operated underwater, the results and sound characteristics used would be difficult to extrapolate.*

For seismic surveys, NMFS (1995) concluded that there would be no hearing damage or TTS to pinnipeds in the water if the received level of seismic pulses did not exceed 190 dB re 1µPa. This criterion was based on exposure to low frequency sound signals, and has been used in several recent seismic monitoring and mitigation programs (e.g. NMFS, 1995, 1997). In addition, this 190 dB re 1µPa criterion for pinnipeds was supported by marine mammal and acoustics experts at NMFS' 1998 acoustic criteria workshop. Pinnipeds, like odontocetes, hear better at higher frequencies (the elephant seal is an exception - it hears better at low frequencies). Seals and sea lions have thresholds of roughly 60 to 80 dB (re 1µPa) in the range of best hearing. In particular, phocids have lower thresholds and a wider frequency range of hearing than otariids. Below about 30-50 kHz, the hearing threshold of phocid seals is essentially flat down to at least 1 kHz, and ranges between 60 and 85 dB re 1µPa. The high frequency cut-off for these true seals is

> *around 60 kHz, based on the species tested. In contrast, the high frequency cut-off for eared seals is 36-40 kHz. The fur seal hearing is most sensitive, ~60 dB re 1µPa, between 4 and 17-28 kHz, where as the California sea lion is apparently the most sensitive, ~80 dB, at 2 and 16 kHz (*in *Richardson* et al*., 1995).*
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> *Using the DRC developed for hearing on humans in air, as described above for odontocetes, the DRC for pinnipeds exposed to 100 pulses in one day emitted by the pulsed power generator might be 224-244 dB_{RMS} re 1µPa (164 dB+ 60-80 dB re 1µPa (hearing threshold for pinnipeds at moderate to high frequencies) = 224-244 dB re 1µPa).*

In short, NMFS argues that the exposure of sea lions to a sound pressure level of 205 dB re 1µPa would not cause temporary or permanent damage to the animals because the threshold for damage increases as the duration of the pulse decreases. The theory and basis for calculating the increase in the threshold sound level is based on a study done on human hearing in the air (dB re 20µPa) as opposed to aquatic hearing (dB re 1µPa).

The Commission has several concerns about NMFS conclusions. First, NMFS proposes an initial threshold for damage to the sea lions of 190 dB re 1µPa. The Commission specifically rejected this threshold in its review of the USGS seismic survey (CD-32-99) in favor of a 180 dB re 1µPa threshold. In addition, 190 dB re 1µPa threshold was developed for evaluating impacts from low frequency sound. Since sea lions are more sensitive to high frequency sound (which is emitted by the pulse power device), it seems likely that the threshold for damage from high frequency sound would be lower then that from low frequency sound. Finally, the use of a study of impacts to human hearing in air is inappropriate for making conclusions about sound pressure levels for sea lions underwater. The NMFS's analysis is based on a discussion within Richardson, et al. Book, **Marine Mammals and Noise**. However, Richardson qualifies the use of his analysis as a basis for making conclusions:

> ***We emphasize that these values are all extremely speculative, given the unknown relevance of human in-air data to marine mammals underwater.*** *As noted earlier, the dynamic range of human hearing may be narrower underwater than in air (Hollien 1993). One should not assume that marine mammals exposed to somewhat lower levels of pulsed underwater sound than those mentioned above would necessarily be "safe" or, on the contrary, that those exposed to somewhat higher levels would necessarily suffer auditory damage. The speculation in the preceding paragraphs is useful not to identify "safe" levels and distances, but rather to identify situations worthy of concern, mitigative action, and further study. (Emphasis in original)*

In other words, the author of the analysis that NMFS uses to justify exposing sea lions to sounds greater than 180 dB re 1µPa states that the analysis should not be used to

determine safe sound pressure levels. Therefore, NMFS does not have a basis to conclude that exposing sea lions to the pulse power device with sound pressure levels as high as 205 dB re 1µPa would not temporarily or permanently damage their hearing. Therefore, the Commission cannot conclude that the proposed project is consistent with marine resource policies of the Coastal Act. Although the Commission does not have the data to demonstrate that the project would adversely affect sea lions, the Commission must err on the side of protecting the resource. The Commission does not have adequate information to conclude that the project would adequately protect the sea lions. Therefore, the Commission finds that the proposed project would not protect biologically significant marine resources as required by Section 30230 of the Coastal Act.

1. **Non-Target Marine Mammals and Sea Turtles.** NMFS proposes to protect non-target marine mammals and sea turtles by creating a safety buffer around the device that would prevent these animals from exposure to pulses with sound pressure levels above 180 dB re 1µPa. If a non-target species enters the buffer zone, the pulse power device would be turned off. In past projects (CD-109-98 (Navy ADS) and CD-32-99 (USGS Seismic testing)), the Commission has accepted buffer zones to protect these sensitive species provided that there was adequate monitoring to ensure protection of the animals. In this case, however, the proposed monitoring is inadequate to ensure that the animals would be identified and the equipment turned off before they are exposed to damaging sound levels. It appears that NMFS proposes to use visual monitoring as the only tool to detect non-target animals within the buffer area. Specifically, NMFS proposes to place two trained persons on the vessel. On of those people would be responsible for operating the pulse power device and the other's duties include monitoring for non-target species, monitoring for sea lions, identifying the number, type, and condition of the fish species that are caught, and collecting data on weather, sea state, and location. It is not possible for one person to simultaneously complete all of these tasks. In order to supplement the on board professionals, NMFS proposes to use the clients of the fishing vessel to help monitor for animals. However, the clients are untrained and may have a vested interest in keeping the device on.

The HESS guidelines recommend the marine mammal monitoring to be conducted by at least two people or three people if they are also responsible for collecting other data. The HESS report also recommends the use of other equipment to monitor for these animals. These monitoring protocols were developed for geologic surveys where the sound source is towed behind the boat and one person can see the entire buffer zone from the stern of the boat.

With respect to the proposed project, NMFS would use one monitor without any additional equipment to supplement the visual monitoring. That monitor would also be responsible for several other tasks that would compete with its responsibility to monitor for marine mammals. In addition, the monitor would not be using any equipment to detect non-target (or even target) species underwater. Additionally, the sound source is under the boat and the vessel is in the center of the buffer zone. The pulse power device could be used while an undetected animal is underwater and

within the 180 dB re 1µPa range. In addition, although NMFS has made a commitment not to use the pulse power device when weather conditions effect visibility, it defines such a state through the use of a Beaufort rating. However, a Beaufort rating is a description of the sea state and does not reflect visual conditions. Therefore, NMFS could test the device when visibility is poor and still be consistent with their commitment. Finally, NMFS does not make any commitment to avoid testing the device during the nighttime. Although the Commission believes that it is unlikely that these chartered fishing boats to fish at night, without a commitment from the NMFS, there is always a possibility that the device would be operated at night. Therefore, the Commission finds that the NMFS has not made sufficient commitments to monitor during the testing of the pulse power device. Without such commitments, the Commission cannot find that the activity protects sensitive marine species in a manner required by Sections 30230 and 30240 of the Coastal Act.

4. **Shock Waves.** The pulse power device produces a shock wave in addition to the sound wave. The NMFS describes the shock wave as follows:

> *When operated, the PPD emits a pulse with a very fast rise time and a combination of a shock wave followed by an acoustic wave. Because of this unique pulse signature, pulses from the PPD, though much less intense (see section 4.3.4), can be compared to the pressure pulses of a small explosive.*
>
> *¼*
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> *The shock from an explosion shows an instantaneous rise in pressure to a maximum value and then decays exponentially. The shock wave carries about half the energy of the explosion and propagates spherically at speeds greater than the conventional 1500 m/s (Medwin and Clay, 1998). The shock front, however, always travels more slowly than the acoustic wave immediately following it, causing the shock front to be overtaken continuously by the acoustic wave during propagation (Rogers, 1977, in Richardson* et al*., 1995). The shock wave, in principal, never dissipates to the point of extinction; in fact, it continually sharpens up, although at long enough ranges, the shock wave is lost in the ambient noise (Gaspin, J., NWSC, Indian Head, MD, July, 1999). In addition, the rise time of the pulse is extremely brief compared to that of an airgun array or other nonexplosive seismic source. The rapidity of the pressure increase (change in amplitude as a function of time) is related to the extent of biological injury (Richardson* et al*., 1995) and must be considered in any analysis of shock wave impacts.*

The biological impact from such a pressure wave occurs from the interaction of soft tissue and hard tissue (i.e. muscle and bone) and to gas filled organs, such as lungs and air blabbers. In evaluating this impact, NMFS concludes that the shock wave pulse power device would not affect fish, marine mammals, birds, or sea turtles. In its environmental assessment, NMFS states that:

> *¼the impulse pressures produced by the PPD would be lower, at a given distance, than the impulse pressures produced by a standard seal bomb and substantially below the impulse pressure produced by a seismic airgun. Furthermore, the impulse pressure produced by the PPD at the 1.8 kJ setting (17 Pa·sec) would fall well below the 35 Pa·sec criteria considered to be safe as estimated for terrestrial animals exposed to underwater blasts (Yelverton 1981). (Yelverton* et al*. (1981) estimates that a safe level (i.e. no injury) for source impulse strength to range from 26 Pa·s for a very small mammal to 210 Pa·s for a large mammal.)*

Based on the information submitted by NMFS, it appears that the shock wave discharged by the pulse power device would not significantly harm marine organisms.

5. **Conclusion**. In conclusion, the Commission finds that the proposed project could expose California sea lions to sound pressure levels that could cause temporary and permanent damage to the hearing of these marine mammals. In addition, the Commission finds that the NMFS has not incorporated sufficient protections for non-target marine mammals and sea turtles into its proposed study. Therefore, the proposed project does not maintain marine resources, protect species of special significance, or protect the habitat from significant disruption, and the Commission finds that the proposed project is not consistent with the Marine Resource Policies of the CCMP.

B. Recreational Fishing Resources. The Coastal Act protects the recreational fishing. Section 30220 of the Coastal Act provides that:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

Section 30234 provides that:

> *Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded. Existing commercial fishing and recreational boating harbor space shall not be reduced unless the demand for those facilities no longer exists or adequate substitute space has been provided. Proposed recreational boating facilities shall, where feasible, be designed and located in such a fashion as not to interfere with the needs of the commercial fishing industry.*

Section 30234.5 provides that:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

The purpose of the proposed project is to protect chartered fishing boat activities from economic impacts associated with sea lion depredation of caught fish and bait. The NMFS proposes to investigate the pulse power device as a non-lethal deterrent. The NMFS describes the current effect that sea lions are having on the chartered fishing boats as follows:

> *The recreational marine fishing industry is an important economic asset in California, estimated to be a $536 million business in southern California, according to the CDFG* [California Department of Fish and Game] *(Beeson and Hanan, 1996). Anglers fish year-round from jetties, piers, beaches, shores, private boats and CPFVs* [commercial passenger fishing vessel]*. Sport anglers pay a fee to ride and fish from CPFVs because these vessels provide the best opportunity for the average angler to catch a variety of fish species.*
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> *Interviews with fishers, reports from state fishing logbooks, and reports to NMFS indicate that California sea lions are negatively impacting CPFV fishing operations, both economically, and socio-economically. Sea lions directly affect CPFV fishing by consuming bait and chum and depredating fish (partially eating fish, rendering them useless for selling or consumption purposes) that have been hooked and are being reeled in (Miller* et al.*, 1983). Typically, during sea lion depredation, the angler rarely sees the sea lion take the fish. Instead, sea lions surface at some distance from the boat, then submerge and swim under it to take a fish or a portion of a fish when the angler has a hook-up (Beeson and Hanan, 1996). The sea lions resurface again at some distance from the boat to consume their catch. The presence of sea lions in the vicinity of a CPFV often stops target fish from feeding on baited hooks and scares fish away, thus reducing angler catch rate. Skippers report that they must frequently move their boats from one fishing area to another because of interactions with sea lions, which results in additional fuel costs and loss of fishing time. (Hanan* et al.*, 1989). Many times with soft bodied fish species, such as the California barracuda (*Sphyraena argentea*), the sea lions simply eat the belly meat and discard the remainder of the fish. Passengers become frustrated when fish cannot be landed because a sea lion has taken or damaged their hooked fish. These interactions occur throughout the year on CPFVs in California that target a variety of fish species, such as, salmon (*Oncorhynchus *spp.), rockfish (*Sebastes *spp.), California barracuda, white seabass (*Atractoscion nobilis*), etc. (Beeson and Hanan, 1996).*
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> *Miller* et al*. (1983) reported that between 1979 and 1981 there were few observed or reported pinniped interactions with charterboat trips in northern California, and depredation in southern California was rare, except in the San Diego area, where pinnipeds adversely affected the halibut gill net and CPFV fisheries. At that time, the California sea lion was the major species involved in fish and gear loss. In 1980, the total*

> *economic loss from depredation by this species in southern California CPFV operations targeting all non-salmonids was estimated to be approximately $38,000. Counts of California sea lions have at least doubled since this study (Barlow* et al. *1995), and the rate of pinniped-fishery interactions has also increased substantially.*
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> *Beeson and Hanan (1996) analyzed CDFG charterboat fishing logs for January-July 1995 and concluded that 26,138 non-salmonids were taken by pinnipeds during this period. Of this total, 97 percent were taken in southern California, with a fresh-fish market value exceeding $145,200. The San Diego area CPFV fleet fishes rockfish, ocean whitefish, and sheephead in the fall and the winter, whereas California barracuda and white seabass are targeted in the spring and summer, and basses (kelp and sand) are targeted during the summer months and into the fall. Sea lion depredation occurs during all months. In 1994, the San Diego charterboat fleet experienced sea lion depredation (at least one fish taken by a sea lion per trip) throughout the year, ranging from 7 % in February to a high of 38 % of the trips taken in April. The highest percentage of depredated trips occurred from March through May. California barracuda comprised the highest percentage of fish species taken by sea lions, generally during the spring and summer, although rockfish, mackerel, kelp fish and barred seabass were also taken (Beeson and Hanan, 1996).*

From the evidence submitted by the NMFS and second-hand information, it appears that sea lions present a significant impact to this type of recreational fishing. If the proposed device deters sea lions, prevents habituation, and does not harm the sea lions, it would provide an acceptable non-lethal method for improving recreational fishing. However, the significance of the impact that sea lions have on recreation fishing is questionable. According to NMFS, recreational fishing is a $536 million industry. The NMFS uses the commercial value of the fish to estimate the economic impact from the sea lions. The NMFS estimates this impact to be $145 thousand or 0.03% of the recreational fishing industry. Based on these figures, it does not appear that the sea lions are having a significant economic impact. However, the Commission believes that the use of the commercial value of the fish caught on the charter boats does not represent the economic cost of the sea lions. Since the fish caught on these vessels are not sold commercially, the NMFS must show that the sea lions are causing a reduction in charter boat passengers in order to demonstrate an economic impact. Without this type of evidence, the Commission cannot conclude that the proposed project is necessary to protect the recreational fishing industry.

However, the data provided by NMFS indicates that the sea lions are interfering with the recreational activity. If the proposed device is effective and the sea lions do not habituate to it, the pulse power device would benefit this recreational resource. Therefore, the Commission finds that the proposed project would protect recreational fishing activities in a matter consistent with the CCMP.

C. <u>Recreational Diving</u>. The proposed experiment would occur in an area that is also popular for recreational scuba diving. The Coastal Act protects this resource. Section 30220 of the Coastal Act provides that:

Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.

In its environmental assessment, the NMFS proposes the following mitigation for potential impacts to recreational diving:

Although the likelihood that human divers will be in the test area is extremely small, the PPD [pulse power device] *will not be discharged if any dive flags are sighted in the vicinity.*

The proposed pulse power device would be tested in nearshore waters of the coast of San Diego and Imperial Beach, which is an area that is also used for recreational diving. In review the Navy's ADS project (CD-109-98), the Commission raised similar concerns about impacts to recreational diving. In that concurrence, the Commission found that:

In reviewing LFA Phase I research (CD-95-97), the Commission concluded that Navy avoidance of exposing divers to sounds exceeding 130 dB would be adequate, based in part on advice and research from the Navy's Bureau of Medicine and Surgery. Concerns have been raised to the Commission that a swimmer exposed to sound levels around 125 dB during Navy LFA acoustic research in Hawaii experienced adverse reactions.

Because recreational fishing and diving are likely to occur in similar areas, near underwater reefs, the Commission believes that there is a possibility for a conflict between the testing of the device and recreational diving activities. At a minimum, the sounds from the device would annoy divers. There is also a possibility that any divers exposed to sound pressure levels above 130 dB re 1µPa would suffer some hearing damage or interfere with recreation. The NMFS commitment to not discharge the device when dive flags are in the vicinity does not provide the Commission with the necessary assurances that the proposed test would not interfere with recreational diving. If the device is tested in an area also used by recreational divers, they may be underwater and near the fishing boat when the device is discharged, even though their dive boat is not in the vicinity of the fishing boat. Therefore, the proposed project has the potential to interfere with recreational diving and harm or deter divers. The Commission finds that the proposed project does not protect recreational diving in a manner consistent with Section 30220 of the Coastal Act, and therefore, the project is inconsistent with the Recreational Resource policy of the CCMP.